WHAT IS CLAIMED IS:

1. A method for depositing an undoped silicon oxide film on a substrate disposed in a process chamber, the method comprising:

flowing a process gas comprising SiF_4, H_2, a silicon source, and an oxidizing gas reactant into the process chamber;

forming a plasma having an ion density of at least 10^{11} ions/cm^3 from the process gas; and

depositing the undoped silicon oxide film over the substrate with the plasma using a process that has simultaneous deposition and sputtering components, wherein a temperature of the substrate during such depositing is greater than 450°C.

2. The method recited in claim 1 wherein the temperature of the substrate during such depositing is substantially between 500 and 800°C.

3. The method recited in claim 1 wherein the temperature of the substrate during such depositing is substantially between 700 and 800°C.

4. The method recited in claim 1 wherein the silicon source comprises SiH_4.

5. The method recited in claim 4 wherein a ratio of a flow rate of SiF_4 to the process chamber to a flow rate of SiH_4 to the process chamber is substantially between 0.5 and 3.0.

6. The method recited in claim 4 wherein the oxidizing gas reactant comprises O_2.

7. The method recited in claim 6 wherein a flow rate of H_2 to the process chamber is less than 1500 sccm.

8. The method recited in claim 6 wherein a flow rate of O_2 to the process chamber is greater than a factor times a sum of the flow rate of SiF_4 and the flow rate of SiH_4 to the process chamber, the factor being less than about 1.8 for a flow rate of H_2 to the process chamber less than about 300 sccm and being between about 1.8 and 3.0 for a flow rate of H_2 to the process chamber greater than about 300 sccm.

9. The method recited in claim 1 wherein the process gas further comprises an inert gas.

10. The method recited in claim 9 wherein the inert gas comprises He.

11. The method recited in claim 1 wherein the undoped silicon oxide film is a first portion of an undoped silicon oxide layer, the method further comprising:

depositing a second portion of the undoped silicon oxide layer over the substrate; and

etching one of the first and second portions of the undoped silicon oxide layer between depositing the undoped silicon oxide film and depositing the second portion of the undoped silicon oxide layer.

12. The method recited in claim 11 wherein depositing the second portion of the undoped silicon oxide layer is performed before the etching and depositing the undoped silicon oxide film is performed after the etching.

13. The method recited in claim 11 wherein depositing the second portion of the undoped silicon oxide layer comprises:

flowing a second process gas comprising SiF_4, H_2, the silicon source, and the oxidizing gas reactant into the process chamber; and

forming a second plasma having an ion density of at least 10^{11} ions/cm^3 from the second process gas,

wherein a temperature of the substrate during such depositing the second portion of the undoped silicon oxide layer is greater than 450°C.

14. A method for depositing an undoped silicon oxide film on a substrate disposed in a process chamber, the substrate having a trench formed between adjacent raised surfaces, the method comprising:

flowing a process gas comprising SiF_4, H_2, SiH_4, and O_2 into the process chamber, wherein a ratio of a flow rate of SiF_4 to a flow rate of SiH_4 is substantially between 0.5 and 3.0;

forming a plasma having an ion density of at least 10^{11} ions/cm^3 from the process gas; and

depositing the undoped silicon oxide film over the substrate and within the trench with the plasma using a process that has simultaneous deposition and sputtering components, wherein a temperature of the substrate during such depositing is greater than 450°C.

15. The method recited in claim 14 wherein the temperature of the substrate during such depositing is substantially between 500 and 800°C.

16. The method recited in claim 14 wherein the temperature of the substrate during such depositing is substantially between 700 and 800°C.

17. The method recited in claim 14 wherein a flow rate of O_2 to the process chamber is greater than a factor times a sum of the flow rate of SiF_4 and the flow rate of SiH_4 to the process chamber, the factor being less than about 1.8 for a flow rate of H_2 to the process chamber less than about 300 sccm and being between about 1.8 and 3.0 for a flow rate of H_2 to the process chamber greater than about 300 sccm.

18. The method recited in claim 14 wherein the process gas further comprises an inert gas.

19. The method recited in claim 14 wherein the undoped silicon oxide film is a first portion of an undoped silicon oxide layer, the method further comprising:

depositing a second portion of the undoped silicon oxide layer over the substrate and within the trench; and

etching one of the first and second portions of the undoped silicon oxide layer between depositing the undoped silicon oxide film and depositing the second portion of the undoped silicon oxide layer.

20 . A method for depositing an undoped silicon oxide layer on a substrate disposed in a process chamber, the substrate having a trench formed between adjacent raised surfaces, the method comprising, in the recited order:

depositing a first portion of the undoped silicon oxide layer over the substrate and within the trench by forming a high-density plasma that has simultaneous deposition and sputtering components;

etching at least part of the first portion of the undoped silicon oxide layer; and

depositing a second portion of the undoped silicon oxide layer over the substrate and within the trench by forming a high-density plasma that has simultaneous deposition and sputtering components,

wherein depositing at least one of the first portion and the second portion comprises:

flowing a process gas comprising SiF_4, H_2, SiH_4, and O_2 into the process chamber;

forming the high-density plasma from the process gas; and

depositing the at least one of the first portion and the second portion with the plasma at a temperature greater than 450°C.

21. The method recited in claim 20 wherein depositing the at least one of the first portion and the second portion comprises depositing the second portion.

22. The method recited in claim 20 further comprising:

etching at least a part of the second portion of the undoped silicon oxide layer; and

depositing a third portion of the undoped silicon oxide layer over the substrate and within the trench by forming a high-density plasma that has simultaneous deposition and sputtering components.

23. The method recited in claim 20 wherein the temperature is substantially between 500 and 800°C.

24. The method recited in claim 20 wherein the temperature is substantially between 700 and 800°C.

25. The method recited in claim 20 wherein a flow rate of O_2 to the process chamber is greater than a factor times a sum of the flow rate of SiF_4 and the flow rate of SiH_4 to the process chamber, the factor being less than about 1.8 for a flow rate of H_2 to the process chamber less than about 300 sccm and being between about 1.8 and 3.0 for a flow rate of H_2 to the process chamber greater than about 300 sccm.

26. The method recited in claim 20 wherein the process gas further comprises an inert gas.